VEDICKRANTI.IN

THE SCIENCE AND TECHNOLOGY HERITAGE OF ANCIENT INDIA

Shree Bijay*, Sujeet Kumar Jha+, Umesh Kumar Singh^
* ubijay2020@gmail.com, + skharekrishna.98@gmail.com, ^umeshvaidik@gmail.com

Abstract

Bharatavarsha (India) had a glorious tradition of Science and Technology. Our seers had discovered all the laws underlying material and spiritual creation and developed a vast literature for us. This paper is an attempt to presents the knowledge of ancient India in the form of the Vedic literatures and the Shilpa Samhita available with us. Theoretical Knowledge is also corroborated with the practical one. The practical aspect is covered with the examples of physical objects and living traditions that exist in our society. This paper also discussed the causes of fall of our past heritage and the way to restore it again.

Keywords- Vedas, Shilpa Samhita, Shilpa Shastras, Vidya, Kala.

1. INTRODUCTION

In the present Western knowledge system, ancient Bharatavarsha (India) on account of changes of time has come under the influence of the Westerners and has attained a high state of civilization. This is due to the introduction of scientific achievements in India by the Westerners. It is also asserts that the scientific achievement or literary work on it were never known in India. All the works in India are remarkably backward in civilization.

But the works did by Swami Dayanand Saraswati on Vedas, Rao Saheb Krishnaji Vinayaka Vaze on Shilpa Shastras and Acharya Dharampal on collecting the documents pertaining to the scientific tradition existing in our society and its transferred to the West during the pre-colonial period; shows that India had attained a high state of civilization in past in contrast to the present theory of backwardness propounded by the West.

These scholars studied our indigenous knowledge system against the present so called modern knowledge system and proved that Indian society was in its zenith in scientific tradition when the West was thinking to write large numbers.

2. FLOW OF KNOWLEDGE IN INDIAN TRADITION

India’s traditional knowledge heritage flows in two streams, viz.

2.1 प्राकृत शाखा (VERNACULAR OR FOLK STREAM)

This stream of knowledge is flowing from time immemorial. It is a living tradition in which knowledge flows from one generation to the next generation. Many branches of engineering science are now not in practiced due to the systematic obliteration of it during the foreign rule. But many branches are still alive and are practiced by the local communities in many parts of India.

2.2 संस्कृत शाखा (CODIFIED OR CLASSICAL STREAM)

This stream is a stream of knowledge with extremely sophisticated theoretical foundation. It is the written form of vernacular or folk stream. When संस्कार (modification, generalization and reflection) is carried out on the vernacular or folk stream, we get the codified stream of knowledge.

Despite of the loss of vernacular knowledge, the codified stream is still with us in the form of Samskrit manuscripts which is yet to be deciphered.

3. SOURCES OF KNOWLEDGE

The Indian knowledge system encompasses of the Vedas and its allied texts[1] which are given as follows-

3.1 वेद (THE VEDAS)

The Vedas are the foundation head of all knowledge in Indian tradition and are considered as अपौरुषेय (not created or written by human). The Vedas (Rig, Yajur, Sama and Athrava) were revealed by the God in the beginning of creation of universe to the Rishies Agni, Vayu, Aaditya and Angiraa respectively for the moral, spiritual-physical guidance and uplift of humanity. This process is going on since eternity and will go for ever.

The Vedas contained in them the gems of all true sciences. They aren’t the scriptures of mere rituals and sacraments but are the repositories of all knowledge. For the correct interpretation of Vedas, the words should be in their derivative, analytical sense. Western scholars on Vedas like Griffith, Max Muller, Monier William, Mac Donnel and Bloomfield had interpreted the Vedas wrongly and failed to understand the eternal truth[2]. Swami Dayanand Saraswati, by virtue of God grace, had studied the ancient Grammar “Ashtadhyayi” of Maharshi Panini, Etymology “Nirukta” of Maharsi Yaska. Based on these he had rejuvenated the tradition of scientific explanation of the Vedas. In his book “Rigvedadi Bhashya Bhumika” (1878), he had given the Science & Technology present in the Vedas few examples are given below.[2]

3.1.1 **MATHEMATICS**

एका च मे तिस्रश्च मे तिस्रश्च मे पञ्च च मे पञ्च च मे सप्त च मे सप्त च मे नव च मे नव च मे एकादश च मे एकादश च मे त्रयोदश च मे त्रयोदश च मे पञ्चदश च मे पञ्चदश च मे सप्तदश च मे शप्तदश च मे नवदश च मे नवदश च मे एकविंशतिश्च मे एकविंशतिश्च मे त्रयोविंशतिश्च मे त्रयोविंशतिश्च मे पञ्चविंशतिश्च मे पञ्चविंशतिश्च मे सप्तविंशतिश्च मे सप्तविंशतिश्च मे नवविंशतिश्च मे नवविंशतिश्च म एकत्रिंशच्च म एकत्रिंशच्च मे त्रयस्त्रिंशच्च मे त्रयस्त्रिंशच्च मे यज्ञेन कल्पन्ताम् ।। १ ।।

चतस्रश्च मेऽष्टौ च मेऽष्टौ च मे द्वादश च मे द्वादश च मे षोडश च मे षोडश च मे विंशतिश्च मे विंशतिश्च मे चतुर्विंशतिश्च मे चतुर्विंशतिश्च मेऽष्टाविंशतिश्च मेऽष्टाविंशतिश्च मे द्वात्रिंशच्च मे द्वात्रिंशच्च मे षट्त्रिंशच्च मे षट्त्रिंशच्च मे चत्वारिंशच्च मे चत्वारिंशच्च मे चतुश्चत्वारिंशच्च मे चतुश्चत्वारिंशच्च मेऽष्टाचत्वारिंशच्च मेऽष्टाचत्वारिंशच्च मे यज्ञेन कल्पन्ताम् ।। २ ।। यजुर्वेद १८.१४,२५.

The above two verses of Yajurveda reveals the science of Mathematics i.e. Arithmetic, Algebra and Geometry:-

EXPLANATION

When the numeral signifying unity is added to another such numeral, it makes two, one and two make three, two and two make four, three and three make six. In the same way the numeral four, five etc. occurring in these verses show that the science of Mathematics is evolved by treating the figures in different ways such as addition, multiplication etc.

3.1.2 THE SCIENCE OF TELEGRAPHY

युवं पेदवे पुरुवारमश्विना स्पृधां श्वेतं तरुतारन्दुवस्यथः ।

शर्यैरभिद्युं पृतनासु दुष्टरं चर्कृत्यमिन्द्रमिव चर्षणीसहम् ॥ ऋग्वेद १.८.२१.५.

The above verse is of Rig-Veda reveals the science of telepathy.

EXPLANATION

O men, you should prepare the (telegraphic apparatus) of pure white metal being a good conductor of fierce electricity and it should be charged with electricity. It should also have qualities of the Ashwin. It has a number of good advantages and therefore most of the learned use it.

3.1.3 THE ART OF BUILDING SHIPS AND AERIAL CARS

तुग्रो ह भुज्युमश्विनोदमेघे रयिं न कश्चिन् ममृवानवाहाः।

तमूहथुर्नौभिरात्मन्वतीभिरन्तरिक्षप्रुद्भिरपोदकाभिः ॥ ऋग्वेद १.८.८.३

The above verse of Rig-Veda reveals the art of building ships and aerial cars.

EXPLANATION

Person who desirous of wealth with the help of physical and material science should construct ships with metals e.g. Iron, copper, silver or with wood etc. and by using the heat and light should produce energy. These substances when rightly used enable men to go from one country to another with all comforts. Similarly conveyances of many of many other kinds' e.g. Aerial cars can be constructed with the above mentioned materials and means.

Maharshi Bharadwaj studied the Vedas and explored the knowledge of air and space travel and written a book called “यंत्रसर्वस्व”. The commentator Bodhananda writes

निर्मथ्य तव्देदाम्बुधिमं भरद्वाजो महामुनि: I

नवनीतमं समुद् धृत्य यन्त्रसर्वस्व रूपकम II यन्त्रसर्वस्व (वैमानिक प्रकरण १/१)

EXPLANATION

Bharadwaj muni has churned the ocean like Veda and has given the butter like “यंत्रसर्वस्व” for the welfare of the human kind.[3]

3.2 वेदांग (VEDANGA)

वेदांग (limbs of the Vedas) are six supplementary texts associated with the study and understanding of Vedas.

1. शिक्षा (Phonetics)
2. कल्प (Rituals)
3. व्याकरण (Grammar)
4. निरुक्त (Etymology)
5. छन्द (Prosody)
6. ज्योतिष (Astronomy)

3.3 उपांग (UPANGA)

उपांग (philosophy) are the six schools of Indian philosophy. These literatures speak about the philosophy from the Vedas through analysis as described by our Rishies.

1. न्याय (Nyaya)
2. वैशेषिक (Vaisheshika)
3. सांख्य (Saankhya)
4. योग (Yoga)
5. मीमांसा (Meemaamsaa)
6. वेदान्त (Vedanta)

Each of the Veda is in five parts. Those are

1. संहिता (Samhitas)

2. ब्राह्मण (Brahmanas)
3. आरण्यक (Aranyakas)
4. उपनिषद (Upanishads)
5. कल्प (Kalpa)

3.4 उपवेद (UPAVEDA)

The science and technology presently in our Vedas are classified by our Rishies into four categories called उपवेद (applied knowledge). These are

1. आयुर्वेद (Medicine)
2. धनुर्वेद (Archery)
3. गान्धर्ववेद (Music, song and dance)
4. स्थापत्यवेद (Engineering)

4. शिल्पसंहिता (SHILPA SAMHITA)[4,17]

Shilpa Samhita comes under the Upaveda स्थापत्यवेद. This is the engineering branch of our ancient science and technology. The samskrit name for engineering is शिल्प (Shilpa) which is derived from the word शिल् (Shil) and means a science dealing with the production of things required for the satisfaction of human wants.

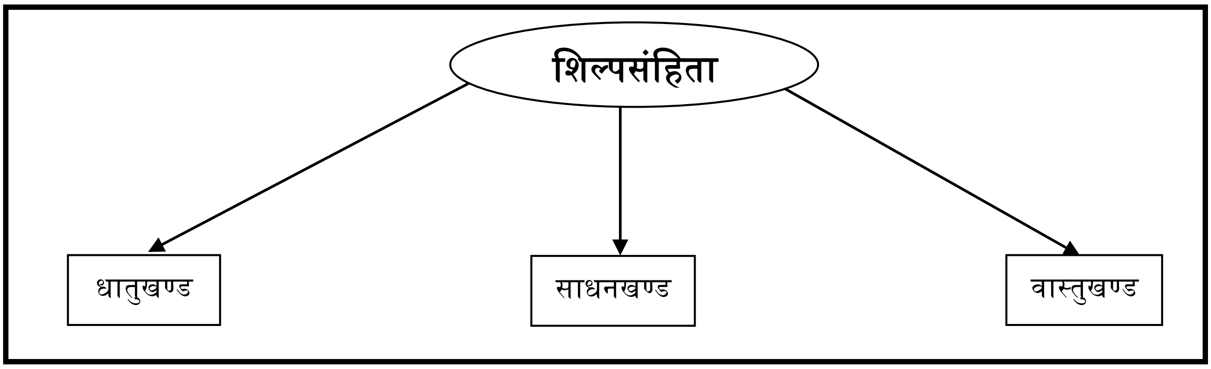
4.1 DEFINITION OF SHILPA

नानाविधानां वस्तूनां यन्त्राणां कल्पसम्पदाम्।
धातूनां साधनानां वास्तु नाम शिल्पसंज्ञितम्॥ भृगुसंहिता

Maharshi Bhrugu in his treaties "भृगुसंहिता" gives the definition of Shilpa as:-
"Many types of objects (products), machines and techniques used for extraction, transportation and habitats are called as Shilpa."

4.2 EXTENT OF SHILPA SAMHITA

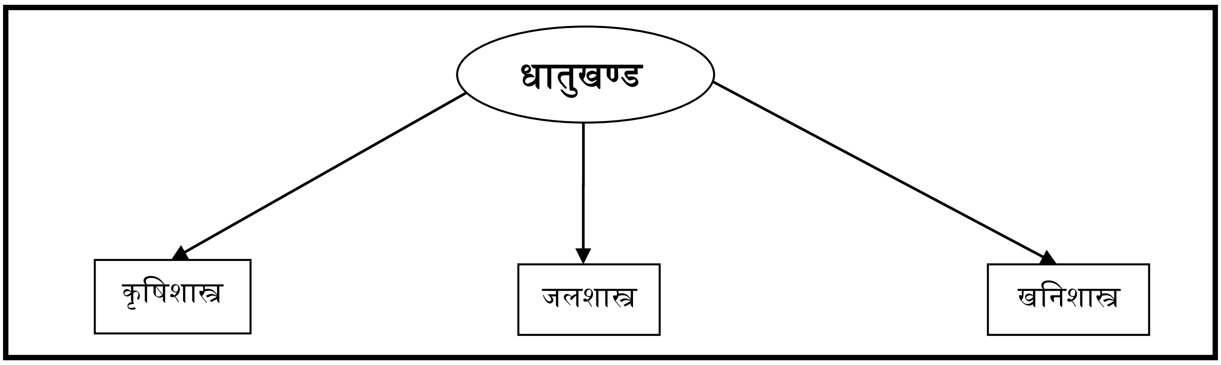
शिल्पसंहिता or "Engineering encyclopedia" is divided into three parts (Figure 1), according to the labour required.



(SHILPA SAMHITA, Figure 1)

5. धातुखण्ड (METAL VOLUME)

धातुखण्ड (metal volume) is sub-divided into Agriculture Engineering, Water Resource Engineering and Mining and Metallurgy Engineering (Figure 2).



(METAL VOLUME, Figure 2)

5.1 कृषिशास्त्र (AGRICUTLTURE ENGINEERING)

कृषिशास्त्र (Agricultural Engineering) is the science of the production, regarding and uses of trees, animals and man. It deals with three subjects, viz.

1. वृक्षविद्या (Plantation)
2. पशुविद्या (Animal Sciences)
3. मनुष्यविद्या (Human Resources)

An engineer in his professional work has to deal with both organic, inorganic substances and amongst organic substances not only with the vegetable and animal kingdom but also with human beings in all their grades. Engineers have to use all labourers, artisans and even specialists in various sciences in the construction of their works and therefore must know the properties, qualities and defects of these human beings as well as the inorganic substances or of vegetables and animal. This branch of study is wholly neglected in the West while it plays an important role in our ancient engineering.

The knowledge of ancient agricultural science was in practiced during pre-colonial period in India. According to Palm leaf record, a British survey of 2000 villages of Chengalpattu near Chennai between 1762 and 1766 says, there were villages which produced up to 12 tons of paddy a hectare.[5] This level of productivity can be obtained only in the best green revolution area of the country with most advanced, expensive and often environmentally ruinous technologies.[6]

5.2 जलशास्त्र (WATER RESOURCES ENGINEERING)

जलशास्त्र (water resources engineering) deals with three subjects viz.

1. संसेचनविद्या(Irrigation)
2. संहरणविद्या (Drainage of Water)
3. स्तम्भनविद्या (Storage of Water)

Indians are known to be born irrigation Engineers as is manifest from the various small and large canals and other irrigation works built by them in different parts of India from time immemorial. “**THE ANICUT DAM”** (Figure 3) built on the Kaveri River isconsidered one of the oldest water-diversion or water-regulator structures in the world, which is still in use.[7]

(THE ANICUT DAM, Figure 3)

5.3 खनिशास्त्र (MINING AND METALLURGY ENGINEERING)

खनिशास्त्र (mining and metallurgy engineering) deals with the following subjects viz.

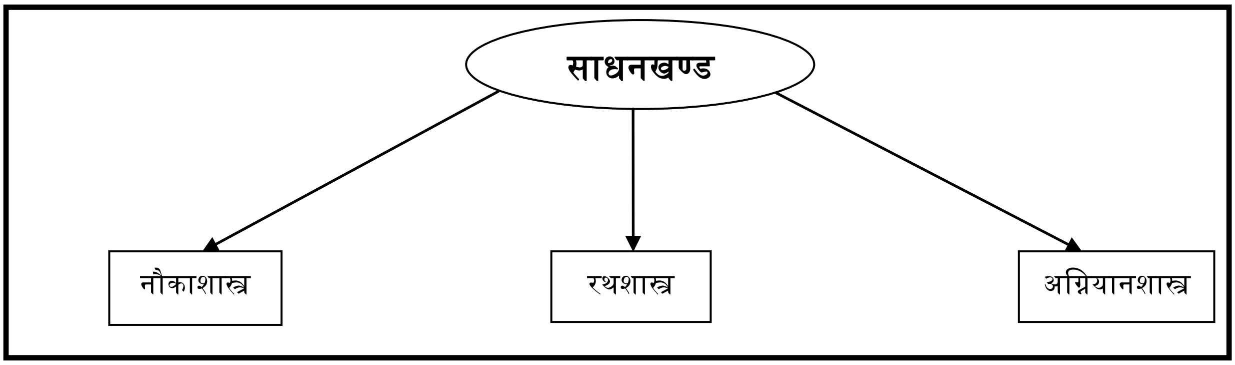
1. दृतिविद्या (Gemology)
2. भस्मीकरणविद्या (Calcination)
3. संकरविद्या (Making of Alloys)

Indians were producing best quality of steel (known as WOOTZ STEEL) which was purchased by the rest world at premium price. The steel produced was not only used in house hold work but also even to manufacture swords and even used in surgical instruments.[8] Also the corrosion resistant Iron Pillar at Delhi (Figure 4) and Mangalore along with the iron ingots at Dhar and Konark are the living examples of our marvelous metallurgical tradition.[9]

(IRON PILLAR AT DELHI, Figure 4)

6. साधनखण्ड (TRANSPORT VOLUME)

साधनखण्ड (transport volume) is sub-divided into Water Transport, Surface Transport and Air or Space Travel (Figure 5).



(TRANSPORT VOLUME, Figure 5)

6.1 नौकाशास्त्र (WATER TRANSPORT)

Transportation by running water is the easiest and नौकाशास्त्र (water transport) is divided into three parts viz.

1. तरीविद्या (Rafts)
2. नौविद्या (Boating)
3. नौकाविद्या (Shipping)

Rafts are floated in water and goes as it carries them, boat is helped by wind in sail and ship is rowed, sailed and floated.

In India, ship building (Figure 6) was carried out based on “युक्तिकल्पतरु” of Raja Bhoja. In his book Raja Bhoja says that no iron should be used in joining the planks in the bottom of a ship. This exposes the ship to the influence of magnetic rocks in the sea and brings it within the magnetic field causing it to sink.[10]

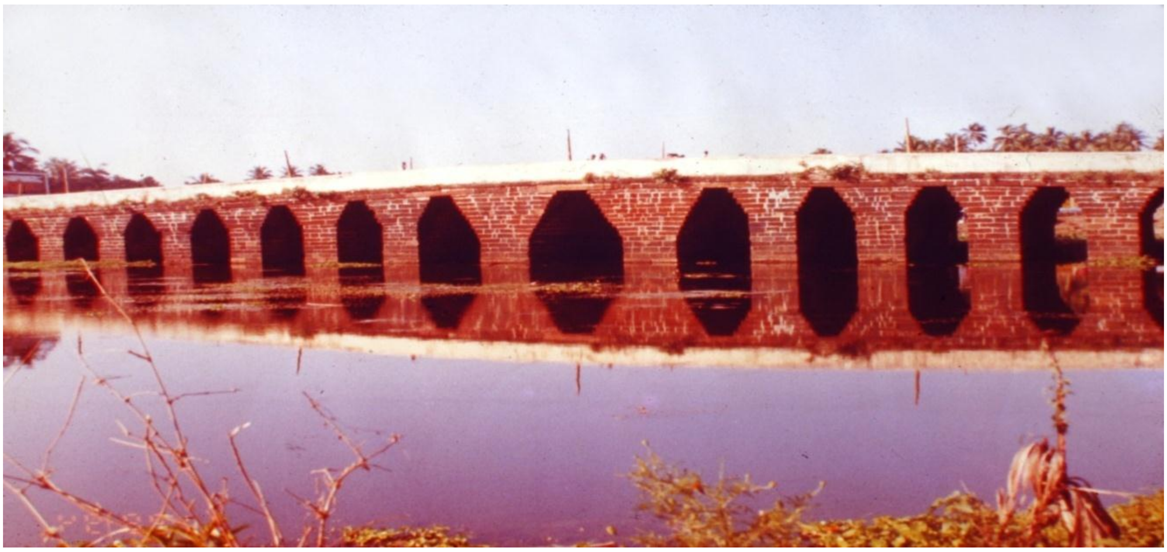
(SHIP BUILDING, Figure 6)

6.2 रथशास्त्र (SURFACE TRANSPORT)

रथशास्त्र (surface transport) deals with the construction of paths, clear roads and paved as metallic roads. It is divided into four parts viz.

1. अश्वविद्या (Horse Riding)
2. पथविद्या (Construction of Roads)
3. घंटापथविद्या (Hill Roads)
4. सेतुविद्या (Construction of Bridges)

The Atharanala Bridge (Figure 7) over the Madhupur stream, north-east of Puri, Odisha is built of sandstone and laterite. It is 84 m. long, 5.4 m. wide and has 19 openings and is still in use from last 1000 years which shows the sustainability of ancient Indian engineering science.[11]



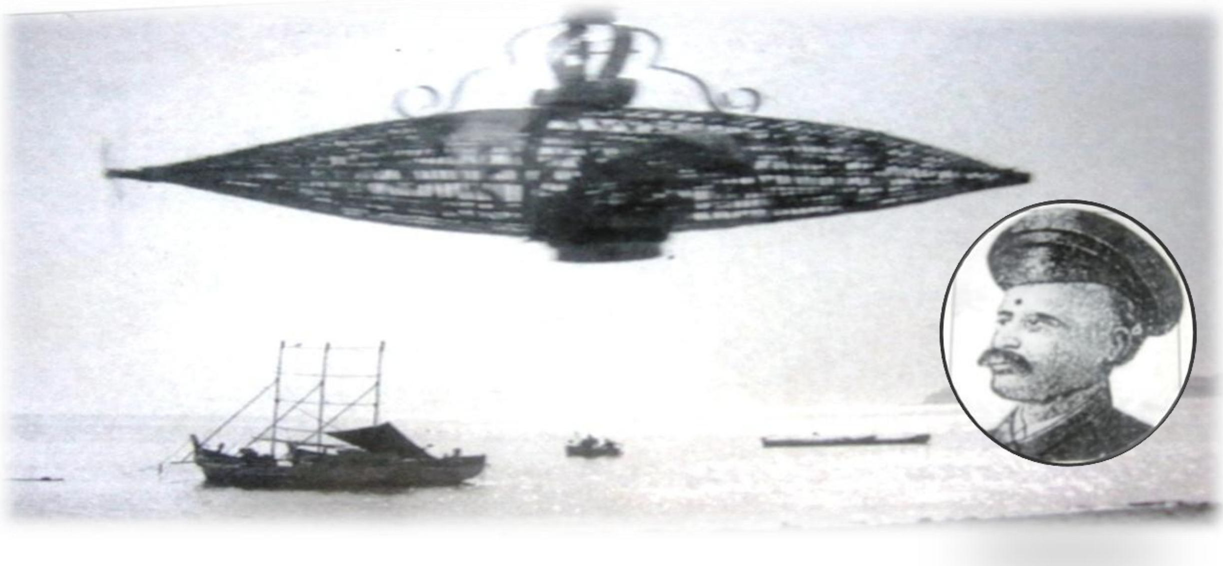
(ATHARANALA BRIDGE AT PURI, Figure 7)

6.3 अग्नियानशास्त्र (AIR OR SPACE TRAVEL)

अग्नियानशास्त्र (air or space travel) deals with the air and space travel by using the birds, aircrafts and spacecraft. It is divided into two parts viz.

1. शकुन्तविद्या (Training Birds)
2. विमानविद्या (Air and Spacecraft)

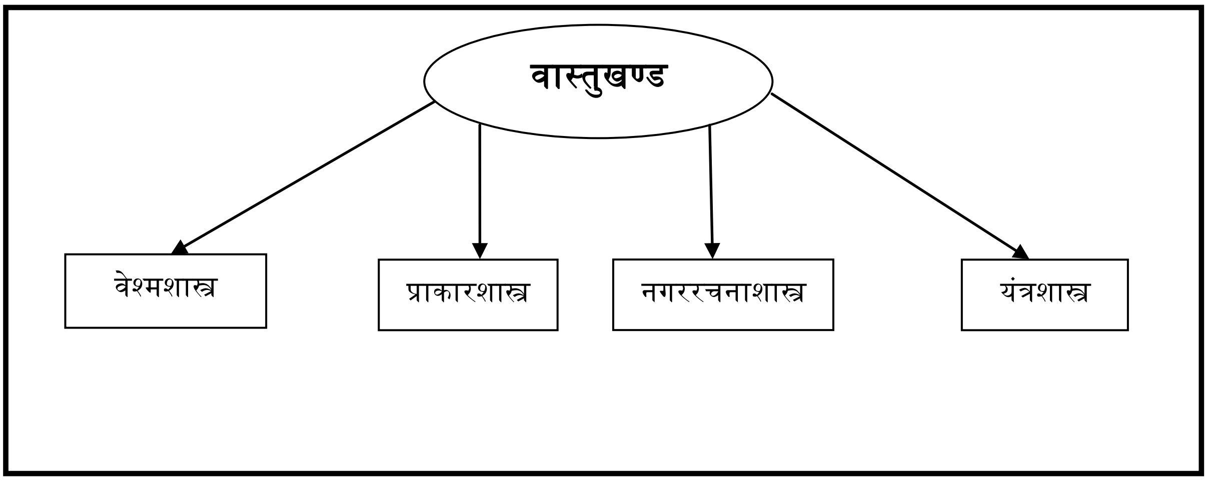
Pandit Shivkar Bapuji Talpade had constructed an unmanned aircraft called "Marutsakha" (Figure 8) which was based Mercury ion engine prepared according to the text of Maharshi Bharadwaj's "Anshubodhini" and "Yantrasarwaswa". He flew the aircraft in 1895 at Chowpaty in Mumbai in front of the public.[12,13] Talpade has written a book called "Prachina Vimana Kalecha Sodha" in which he gave the modality of flying.[14]



(MATUTSAKHA AND TALPADE, Figure 8)

7. वास्तुखण्ड (CONSTRUCTION WORK VOLUME)

वास्तुखण्ड (construction work volume) is sub-divided into Dwelling, Forts and Castles and Town Planning (Figure 9).



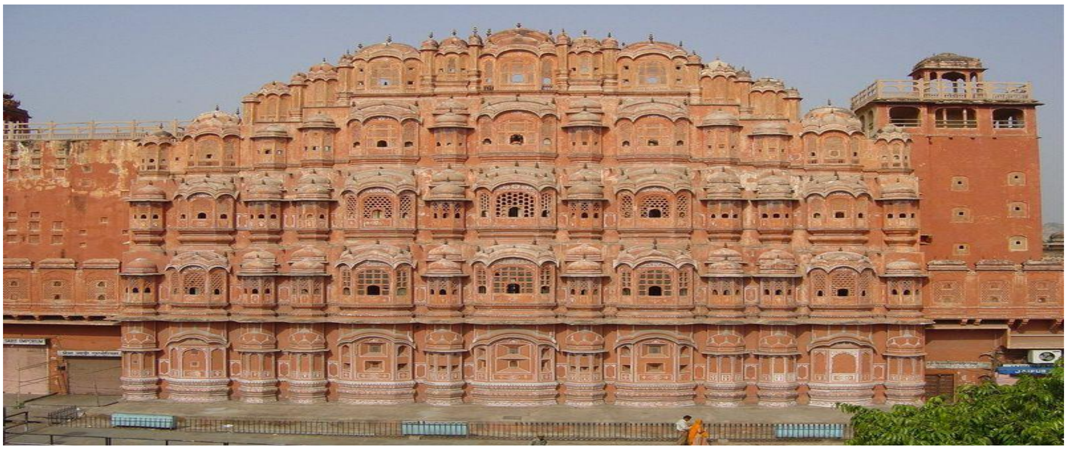
(CONSTRUCTION WORK VOLUME, Figure 9)

7.1 वेश्मशास्त्र (DWELLING)

वेश्मशास्त्र (dwelling) is divided into four parts viz.

1. वासोविद्या (Tents)
2. कुट्टीविद्या (Huts)
3. मंदिरविद्या (Houses)
4. प्रासादविद्या (Palaces)

हवा महल also known as Palace of Winds (Figure 10) was built in 1799 by Maharaja Sawai Pratap Singh, and designed by Lal Chand Ustad in the form of the crown of Krishna. Its unique five-storey exterior is also akin to the honeycomb of the beehive with its 953 small windows called Jharokha that are decorated with intricate lattice work.[15]



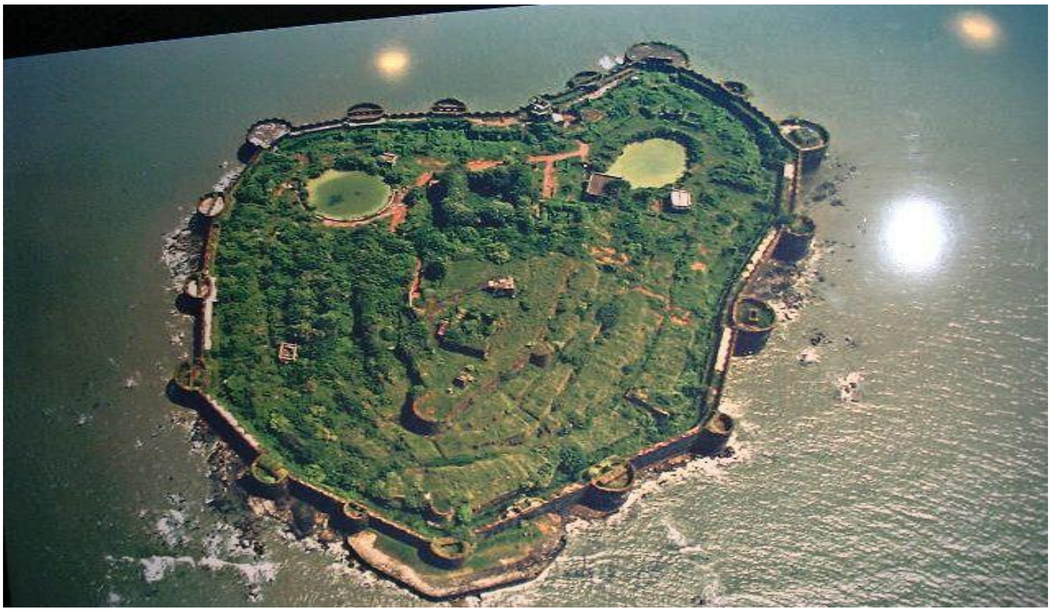
(WAHA MAHAL AT JAIPUR, Figure 10)

7.2 प्राकार शास्त्र (FORTS AND CASTLES)

प्राकार शास्त्र (forts and castles) deals with fortification and various kinds of defence work. It is divided into four parts viz.

1. दुर्गविद्या (Forts)
2. कूटविद्या (Castles)
3. आकारविद्या (Moats)
4. युद्धविद्या (Warfare)

Sindhu Durg (Figure 11) is a fortress; build by Hiroji Indalkar Deshmukh, the master Architect of Shivaji Maharaja in 1664. It occupies an islet in the Arabian Sea, just off the coast of Maharastra. The fortress lies on the shore of Malvan town of Sindhudurg District of the Konkan region of Maharashtra.[15]



(SINDHURG DURG, Figure 11)

7.3 नगररचनाशास्त्र (TOWN PLANNING)

In नगररचनाशास्त्र (town planning) planning of town of various shapes and sizes under different conditions is described in detail, selection of sites, supply of amenities, construction of temples, court places, recreation grounds, educational and charitable institutions, disposal of waste products and the allotment of land for market and trade centers are the chief section of this science. It is divided into five parts viz.

1. आपणविद्या (Market)
2. राजगृहविद्या (Palace)
3. सर्वजनवासविद्या (Public Place)
4. वनोपवनविद्या (Garden)
5. देवालयविद्या (Temple)

काशी known as Varanasi (Figure 12) is a city on the bank of Ganges in Uttar Pradesh is one of the oldest continuously inhabited city in the world and the oldest in India is planned as per the नगररचना शास्त्र.[16]

BENARES.
A Brahmin placing a Garland on the holiest Spot in the sacred City
Drawn on Stone by J. D. Harding from a Sketch by James Prinsep Esq.

(VARANASI CITY, Figure 12)

7.4 यंत्रशास्त्र (MACHINE)

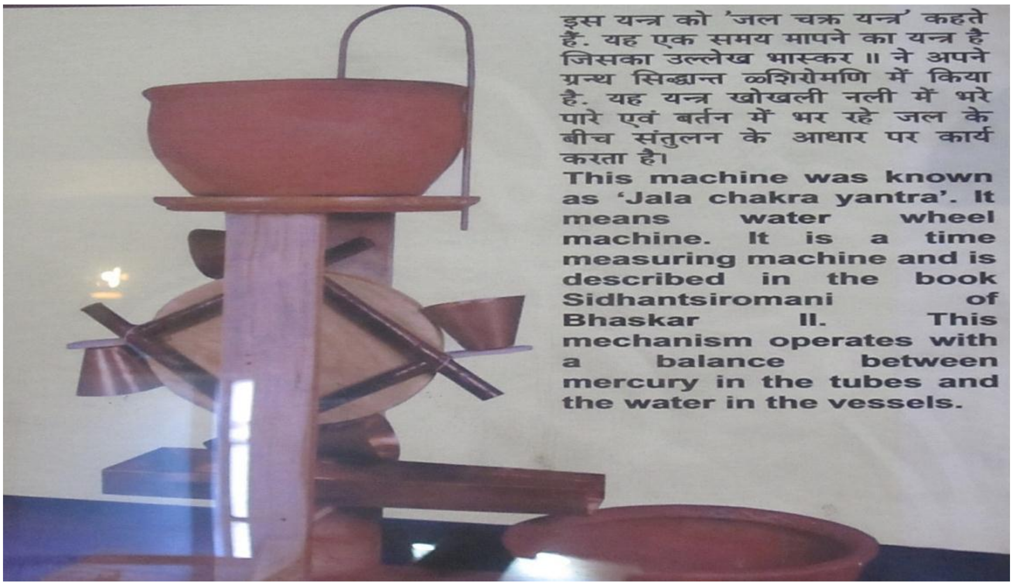
यंत्रशास्त्र (machine) is the tent Shastra and is common to all other nine Shastra. This Shastra doesn't contain any techniques or skill.

DEFINITION OF YANTRA

Yantra is a mechanical contrivance in which one or more mechanical appliances are used for transmitting and changing direction and place, "Samarngana Sutradhar" gives definition of a Yantra.[10]

"All mechanics or mechanical contrivance which creates motion by artificial mean are called Yantra."

The "जलचक्र यंत्र" or Water-Wheel Machine (Figure 13) is a time measuring machine described in the book "सिद्धांतशिरोमणि" of Bhaskarachary-2.[17]



इस यन्त्र को 'जल चक्र यन्त्र' कहते हैं. यह एक समय मापने का यन्त्र है जिसका उल्लेख भास्कर ॥ ने अपने ग्रन्थ सिद्धान्त ळशिरोमणि में किया है. यह यन्त्र खोखली नली में भरे पारे एवं बर्तन में भर रहे जल के बीच संतुलन के आधार पर कार्य करता है।

This machine was known as 'Jala chakra yantra'. It means water wheel machine. It is a time measuring machine and is described in the book Sidhantsiromani of Bhaskar II. This mechanism operates with a balance between mercury in the tubes and the water in the vessels.

(WATER WHEEL MACHINE, Figure 13)

8. CAUSES OF FALL OF INDIAN SCIENCE AND TECHNOLOGY HERITAGE

The causes of fall of Indian science and technology heritage can be summarized below.

1. Foreign Aggressions- Most of the texts were destroyed during foreign aggressions and some very important texts were taken to other countries by scholars. There were more than 20,000 texts on technical subjects but by 20th century the number diminished to less than 1200.[18]

2. Language- Most of the texts are written in Samskrit. Scientists and engineers didn't know this language. Samskrit scholars didn't know engineering.

3. Improper Interpretation- Many Samskrit texts were wrongly interpreted due to lack of Sanskrit knowledge and lost it utility.

4. Distortion in Indian History- The history of India was distorted by the Western scholars deliberately and the same was introduced in Indian education system. Due to this educated class, unaware of its glorious past, think that ancient Indian text lacks science and technology in it.[19]

9. METHODS TO REJUVANATE THE GLORIOUS TRADITION

The glorious tradition of scientific and technological heritage can be again re-established by following the path of our scholars who had shown the way to us in this respect. Some of them are:-

1. Learning our ancient Samskrit language in Vedic way as prescribed by Swami Dayanand Saraswati.[1]

2. Study the true history and the Vedic Dharma of India through the Indo-centric approach contrary to the present one.[1,19]

10. CONCLUSION

Samskrit language is the treasure house of all knowledge on science and technology of ancient India. Engineers and scientists should start learning this language. Along with this we have to look into our past from our own Indian point of view then only the glorious tradition of India can be restored.

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PHOTO SOURCES

1. Figures 1, 2, 5, 9 and 13-personal source.
2. Figures 3, 4, 6, 10, 11, and 12- from www.wikipedia.org.
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